

St. Louis Union Station Powerhouse
On South 18th Street
St. Louis (Independent City)
St. Louis County
Missouri

HAER No. MO-23

HAER
MO,
96-SALV,
80-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Rocky Mountain Regional Office
National Park Service
Department of the Interior
P.O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

HAER
MO
96-SALU,
80 -

St. Louis Union Station Powerhouse

HAER No. MO-23

Location: Located on the west side of the South 18th Street viaduct approach ramp, immediately north of and adjacent to U. S. Highway 40 in St. Louis, (Independent City), Missouri.

Date of Construction: 1903. Alterations at various dates (see text).

Alterations:

Turbo Compressor Room	1912
Transformer House	Unknown
Water Treatment Plant	1943
Engineer's Office	1944
Pump House - Third Floor	1945
Locker and Toilet Rooms	1950

Equipment:

Ash Bin and Elevator	1910
Coal Hopper and Conveyor	1916
New B&W Boiler (including Raise Roof, New Basement Floor, New Coal Hopper and Conveyor)	1948
Numerous Other Modifications and Modernizations	Dates Vary

Outbuildings:

Airtank and Coil Building (Not Extant)	1903
Toolhouse (Not Extant)	1911
Enlarge Toolhouse for Interlocking Cooling Tower (Not Extant)	1926

Present Owner: St. Louis Station Partners

Present Use: Vacant

Projected Date of Demolition: 1986

Significance: The Union Station Powerhouse is significant in the following areas:

Community Planning: The building represents a significant period in the expansion of the Terminal Railroad Association facilities at Union Station, the nation's largest railroad terminal at the turn of the century. The building was one of several structures

erected in the years 1902-1904 in the rail yards behind Union Station to accommodate the increased passenger and freight business anticipated throughout the 1904 World's Fair in St. Louis. The powerhouse was critical to a carefully engineered plan which, despite the obstacles of space limitations and ceaseless traffic, successfully increased the freight handling capacity of Union Station twofold.

Architecture: Constructed in 1903 from plans drawn up by Chicago architects Holabird and Roche with consulting engineers Purdy & Henderson, the powerhouse is a good representative example of industrial design with primary emphasis on utility and function. While there is little concession to extraneous detailing, architectural considerations are expressed in the brickwork, fenestration and fine proportions. Concrete foundations, reinforced concrete floors, and a concrete and tile roof carried on steel trusses and I-beams represented up-to-date structural methods which met requirements of maximum load-bearing strength and fire-proofing.

Narratives Prepared by: Landmarks Association of St. Louis

Report Assembled by: Deborah M. Rehn
Mackey & Associates, Architects
July 1986

Edited, Retyped
& Transmitted by: Jean P. Yearby, HAER, 1987

DESCRIPTION

Constructed in 1903 from plans of architects Holabird & Roche, the Union Station Powerhouse is a one-story, red brick industrial building located on 18th Street in the former train yards of St. Louis' Union Station. Resting on concrete foundations, the main block of the powerhouse measures approximately 99 feet x 146 feet and is divided lengthwise by a brick fire wall (see Figure 3). The concrete and tile gabled roof is installed with a ventilating monitor, now sheathed; the roof is carried on steel trusses above the engine room and on a system of steel I-beams above the boiler room. Engine and boiler room floors over the basement are concrete arches reinforced with expanded metal between steel girders. Heavy brick pilasters terminating in corbeled brick banding define six bays on the north and south elevations and eleven bays on the east and west elevations. Windows headed with segmental arches, consisting of four rowlock courses of brick, articulate the lower wall of all elevations; a center mullion divides the openings into two double-hung, multi-paned windows headed with a multi-paned transom. The upper walls of the north, south, and west elevations are pierced with pairs of rowlock round-arched, double-hung windows; center bay windows of the north and south elevations are installed with eight over eight lights. They are flanked by windows with four over four lights; outside bays feature windows with two over two lights, as do windows on the west elevations. All windows are fitted with wood frames and stone sills.

Brick pilasters on the east elevation are reinforced with steel columns and are doubled every two bays to carry the additional load created by coal and ash bunkers formerly installed there (see Photographs MO-23-3, MO-23-4 and MO-23-20). A narrow, round-headed window (bricked in) is located at the south end of the wall. The east elevation is extended two bays south to form a small 22 feet by 25 feet pumphouse (see Photographs MO-23-4, center right, and MO-23-20, far left); an additional story was later constructed which features square windows and a gabled end trimmed with corbeled brick similar to detailing of the main block (see Photographs MO-23-4, left, and MO-23-30). At the north end of the east elevation, the wall was extended a few feet above the roof line in 1948 to accommodate installation of a new coal bunker there (see Photograph MO-23-3, far right). Brick masonry pilasters and cornice on this elevation have suffered some deterioration as the result of moisture entering the wall and disturbance when boilers were removed several years ago. Similarly, brick corbeling at the cornice on the west elevation shows signs of deterioration (see Photographs MO-23-7, MO-23-8 and MO-23-9).

A mottled yellow/orange brick chimney stack with a inside diameter of 11 feet and a height of approximately 200 feet stands on a square brick base (trimmed with corbeled brick) at the south end of the powerhouse (see Photographs MO-23-3, MO-23-4 and MO-23-5). It was erected by the Alphons Custodis Chimney Construction Company.

Sometime after the powerhouse was completed, a one-story, 2x4-bay, brick addition on concrete foundations was constructed to house the air compressors at the southwest corner of the building (see Photographs MO-23-5, MO-23-6, MO-23-25, and MO-23-26). The addition is articulated with pilasters, segmentally arched windows, and brick corbeling which closely follows forms and detailing of the original structure. A small, one-story brick addition for transformers is located between the seventh and ninth bays on the west elevation (see Photograph MO-23-7, right). It is pierced with three small windows with soldier course brick lintels and brick sills on the west side and a single window on the south elevation. Another one-story, brick addition houses the water treatment plant and is joined to the south wall of the pump room (see Photographs MO-23-5, right; MO-23-6, right; MO-23-28 and MO-23-29). It is pierced with a single small window on the east and west elevations and two small windows on the south elevation.

HISTORICAL NARRATIVE

At the turn of the century when preparations were underway for the 1904 opening of the Louisiana Purchase Exposition, St. Louis was the fourth largest city in the nation and the center of 22 railways which entered Union Station. Although the terminal was one of the largest railway stations in the world, the rapid increase in traffic had overtaxed the track capacity and other station facilities, since its completion in 1892. Improvements to remedy this situation, which had been under consideration for some time, were finally undertaken in 1903 as a result of the pressing need to accommodate an exceptional increase in freight and passenger traffic anticipated with the opening of the World's Fair in St. Louis, attendance at which was estimated to reach 30 to 35 million people.¹

A comprehensive plan of improvements and reconstruction was drawn up in 1902 by officers and engineers of the Terminal Railroad Association, a corporation founded in 1889 composed six major rail lines (the Ohio & Mississippi; Cleveland, Cincinnati, Chicago & St. Louis (Big Four); Louisville & Nashville; Missouri Pacific; St. Louis, Iron Mountain & Southern; and Wabash) which jointly owned the station facilities. Principal components of the plan included rearrangement and enlargement of the track system, lengthening the train shed 180 degrees, relocation and construction of a new powerhouse, express and baggage buildings, and erection of a post office annex.

As originally laid out (see Figure 1), the approach of the track system consisted of a single, narrow, four-track throat through which every passenger train had to pass along, with trains broken up for car transfer and the separation of baggage, mail, and express business requiring switching movements. The throat was closely shut in on the west by yard tracks and 20th Street and on the east by express company buildings and 18th Street. Such arrangements resulted in congestion and delay, as only two parallel moves could be made through the throat at one time. To alleviate these conditions, it was required that the track system be completed reconstructed, and existing adjunct buildings relocated without discontinuing service to increasingly heavy traffic. In fact, during the two years in which the

majority of construction was in progress, the number of cars handled daily in the station doubled, while the number of leads into the station was temporarily halved by the reconstruction.²

The new track plan (see Figure 2) vastly increased the switching and operating capacity of the terminal by providing two Ys of three tracks each, uniting at two three-track throats, each of which served sixteen train shed tracks. This arrangement now permitted six simultaneous train moves. The old express buildings on the east side of the yards were removed, and the powerhouse was transferred from the center to the east side (see Figures 1 and 2). The new powerhouse was sited to connect with a new subway system designed to communicate with the headhouse, baggage, mail, and express buildings and to carry steam and compressed air pipes, electric wires, etc., from the powerhouse to these terminal buildings (see Figure 2). In order to serve the expanded terminal facilities, the new power plant was significantly increased in size and function. When completed, the building furnished about twice the power (2,750 h.p.) of the old one and occupied a total of 13,660 SF inside the walls. Approximately 58% was devoted to the boiler room, 46% to the electric power machinery, and the remainder allowed for the pump room and machine shop, an extension at the southeast corner of the building (see Figure 3).

At the time the Union Station plant was designed, large generating stations were a relatively new building type, which was rapidly evolving as new systems of power were being developed to serve modern industries. In less than twenty years, plants had developed from small, ordinary buildings to complex structures often of great size, supplying power for numerous purposes. In order to meet the special requirements of the powerhouse, collaboration of two professions, architecture and engineering, was essential to a larger degree than in many other classes of buildings. Architects were needed to provide a suitable outward appearance to the buildings, while engineers were engaged in working out all important structural and mechanical systems involved with the plants.³

Although characteristic features of the building type were not yet fully established, some features had been widely adopted in America and abroad. Foremost among these were requirements that buildings be combustible and capable of carrying unusually heavy loads. Because of the extreme importance of the power generating functions of the building, where work had to be carried on continuously day and night, fireproofing was critical, especially in the roofs of the engine and boiler houses. Building foundations also presented special design problems of supporting enormous loads which often were unevenly disposed, and of preventing vibrations outside the building/ Beyond these fundamental requirements, steam-power buildings also were generally laid out with a one-story and basement engine house, which was separated by a central division fire wall from a boiler house of one or more stories plus basement. The boiler room was installed with flues and an apparatus for feeding coal to the boilers and removing ashes. A coal bunker with sloping floor was located above the boiler room. A pump room and a chimney stack or stacks was also standard features.

Concrete was common for foundations and floors. Wall construction was composed of steel skeleton frames with brick curtain walls, and concrete roofs were supported by steel trusses. A family likeness in American practice is discernible in the use of rectangular plans and exterior elevations, which displayed restraint or absence of ornamentation and large, regular fenestration often with rounded-headed openings.⁴

The powerhouse at Union Station conformed in most ways to the general layout, fireproof construction methods, and exterior design of early 20th century power stations. It brought together some of the most eminent architectural, engineering, and contracting firms in the country: Holabird & Roche of Chicago, who designed the shell; structural engineers Purdy & Henderson of Chicago; Westinghouse, Kerr & Church of New York, who planned the mechanical and electrical systems; and the George A. Fuller Company of Chicago, specialists in fireproof construction. Nationally recognized for their contributions to the design and structural solutions of the tall office block, William Holabird and Martin Roche were associated for many years with consulting engineer Corydon T. Purdy who was among the early group of Chicago engineers responsible for significant advances in steel construction and improved foundation design. The two firms had collaborated on major Chicago buildings, such as the south addition to the Monadnock (1892); the Old Colony (1894), a notable example of innovative wind bracing; the Marquette (1895); and the Tribune (1902), where the first sub-basement in Chicago was introduced and subsequently influenced further development of the basement in the Loop District.⁵ These buildings and others of the firms were constructed by the George A. Fuller Company, whose branch office in St. Louis had erected other buildings in the city. In addition to office buildings, Holabird & Roche prepared plans for numerous public structures, clubs, hotels, and buildings for utilities. Similarly, Purdy & Henderson's work extended to nearly every building type across the country including hotels, apartment houses, theaters, stores, railway stations, factories, and powerhouses.

The rectangular plan of the Union Station powerhouse followed established lines with a longitudinal brick wall separating the engine house from the boiler house, but placed slightly off-center to provide greater space in the boiler house. The southeast corner of the building was extended from the main block to house a pump room on the first level and a machine shop above (see Figure 3). Foundations were concrete on concrete spread footings. Engine and boiler room floors over the basement were concrete arches reinforced with expanded metal between steel girders. Wall construction was self-supporting brick, strengthened by interior and exterior pilasters, which on the east elevation were increased in number and reinforced with steel columns to support the heavier load created by coal and ash bunkers there. The concrete roof was carried on steel trusses above the engine room, permitting a clear span for operating a bridge crane, and on a system of steel I-beams above the boiler room. A monitor along the roof controlled by a mechanical device increased light and ventilation. The 200-foot brick chimney stack, erected by the Alphons Custodis Chimney Construction Company, was fitted with perforated radial brick, a standard feature for American stacks of the period.

For the exterior of the powerhouse, Holabird & Roche provided elevations which successfully expressed the building's purpose and made no attempt to disguise its purely utilitarian character with unnecessary embellishment. Structural elements were accentuated with strongly expressed vertical pilasters which define bays on all elevations and give visual unity to the design. A careful study of fenestration in relation to the width and spacing of the pilasters resulted in fine proportions and scale. Paired round-arched windows evoking Renaissance forms are a slight concession to style, but are of sufficient size to admit ample light and ventilation. Both the round and segmentally arched windows feature wide bands of row-lock bricks, structural elements which also impart visual interest to the wall plane, as does the brick corbeling which frames the prominent gable-ends and trims the upper spandrels and cornice of the side elevations and the base of the chimney stack (see Photographs MO-23-1, MO-23-2 and MO-23-3).

When completed, the powerhouse was reported by Engineering Record to be an exemplary plant, noteworthy for the "extreme diversity" of service it provided to the entire terminal properties, from the heaviest down to the smallest amount of current required for nonetheless vital function such as the signal and telautograph systems. Carried out by consulting engineers Westinghouse, Kerr & Church, the installation consisted of A.C. electric lighting for the headhouse, train shed, mail and express buildings, and engine and switch houses; A.C. and D.C. electric service to all terminal buildings, including power for elevators; high pressure steam for building heating; general water supply, a fire protection system and a high pressure water system for thirty-nine baggage elevators; and compressed air for switch and signal systems, car cleaning and air suction.⁷

The air compressors, originally located in the main block of the engine house and later removed to an annex at the south end of the room (see Figure 3), were integrally related to the reconstruction plan of the track system, as they supplied power for switch movements in the new station interlocking plant (reported the largest in the world) as well as in plants at both ends of the railroad tunnel and at Grand Avenue, two miles west of the terminal. The increased capacity of the new track arrangement at Union Station permitted switch movements during rush hours to occur at a rate of more than one every twenty seconds, each train entering the station averaging fifteen movements.⁸

All construction projects in the rail yards at Union Station approached a stage of completion in the Spring of 1904. Passenger trains handled by the station increased from 7,427 in October 1903 to 14,356 in October 1904. Baggage checked in the same period more than doubled to 2,500 pieces per hour.⁹ The station was in heavy use through the 1940s, when an average of 100,000 people passed through the station daily. However, the introduction of new highway and air transportation systems in the mid-20th century contributed to the eventual abandonment of the established rail network in downtown St. Louis and the eventual demolition of the scattered service buildings. The headhouse and train shed were declared a National Historic Landmark site in 1970. In 1978, the last

train left Union Station, although some years before, powerhouse service had been partially disconnected when Union Electric tied the terminal into its steam loop.

Several unsuccessful schemes were proposed for adaptive reuse of the Union Station complex before a partnership of the Rouse Company and Omni International acquired the property. The headhouse has been restored for office and hotel use; new structures have been built under the train shed. Opened in August 1985, that project prompted renewed interest in the two remaining adjunct buildings in the former train yards. The Post Office Annex (listed in the National Register) has been converted to office space, and plans were carefully considered for adapting the powerhouse to office and commercial use. After exploring a variety of possible uses for the building, from nightclubs to restaurants to office space, it was determined that none of the uses would be architecturally or financially feasible. The superstructure is to be demolished, and a new office building will be built on the original foundations, with an entirely new theatre complex immediately to the south below the highway.

BIBLIOGRAPHY

Bibbins, J. R. "The Power Plant of a Modern Railroad Terminal." Engineering Record. January 28, 1905, pp.92-97.

Breck, David. Report of Chief Engineer to President of Terminal Railroad Association of St. Louis of Work Done During 1902-1903-1904. St. Louis: Buxton & Skinner Print, 1905.

Bruegmann, Robert. "Holabird & Roche and Holabird & Root: The First Two Generations." Chicago History. Fall 1980, pp. 130-165.

Condit, Carl W. "Holabird & Roche." The Chicago School of Architecture, Chapter VII. Chicago: University of Chicago Press, 1964.

Engineering News. September 29, 1904. "Rearrangement of Tracks and Station Facilities at the Union Station, St. Louis, Missouri," pp. 290-294.

Fireproof Building Construction: Prominent Buildings Erected by the George A. Fuller Co. New York: No publisher, 1910.

Leonard, John W. Who's Who in Engineering 1925. New York: Who's Who in Publication, Inc., 1925.

Peach, Charles Stanley. "Notes on the Design and Construction of Buildings Connected with the Generation and Supply of Electricity Known as Central Stations." Journal of the Royal Institute of British Architects. April 2, 1904, pp. 179-318.

FOOTNOTES

- 1 David Breck, Report of Chief Engineer to President of Terminal Railroad Association of St. Louis of Work Done 1902-1903-1904, St. Louis: Buxton & Skinner Print, 1905, pp. 9-12.
- 2 Ibid., pp. 27-28.
- 3 Charles Stanley Peach, "Notes on the Design and Construction of Buildings Connected with the Generation and Supply of Electricity Known as Central Station," Journal of the Royal Institute of British Architects, April 2, 1904, pp. 279-318.
- 4 Ibid., pp. 279-318.
- 5 Carl W. Condit, "Holabird and Roche," The Chicago School of Architecture, Chapter VII, Chicago: University of Chicago Press, 1964.
- 6 John W. Leonard, Who's Who in Engineering 1925, New York: Who's Who Publication, Inc., 1925, p. 1685.
- 7 J. R. Bibbins, "The Power Plant of a Modern Railroad Terminal," Engineering Record, January 28, 1905, pp. 92-96.
- 8 Breck, Report to Chief Engineer, p. 399.
- 9 Breck, Report to Chief Engineer, pp. 27-28.

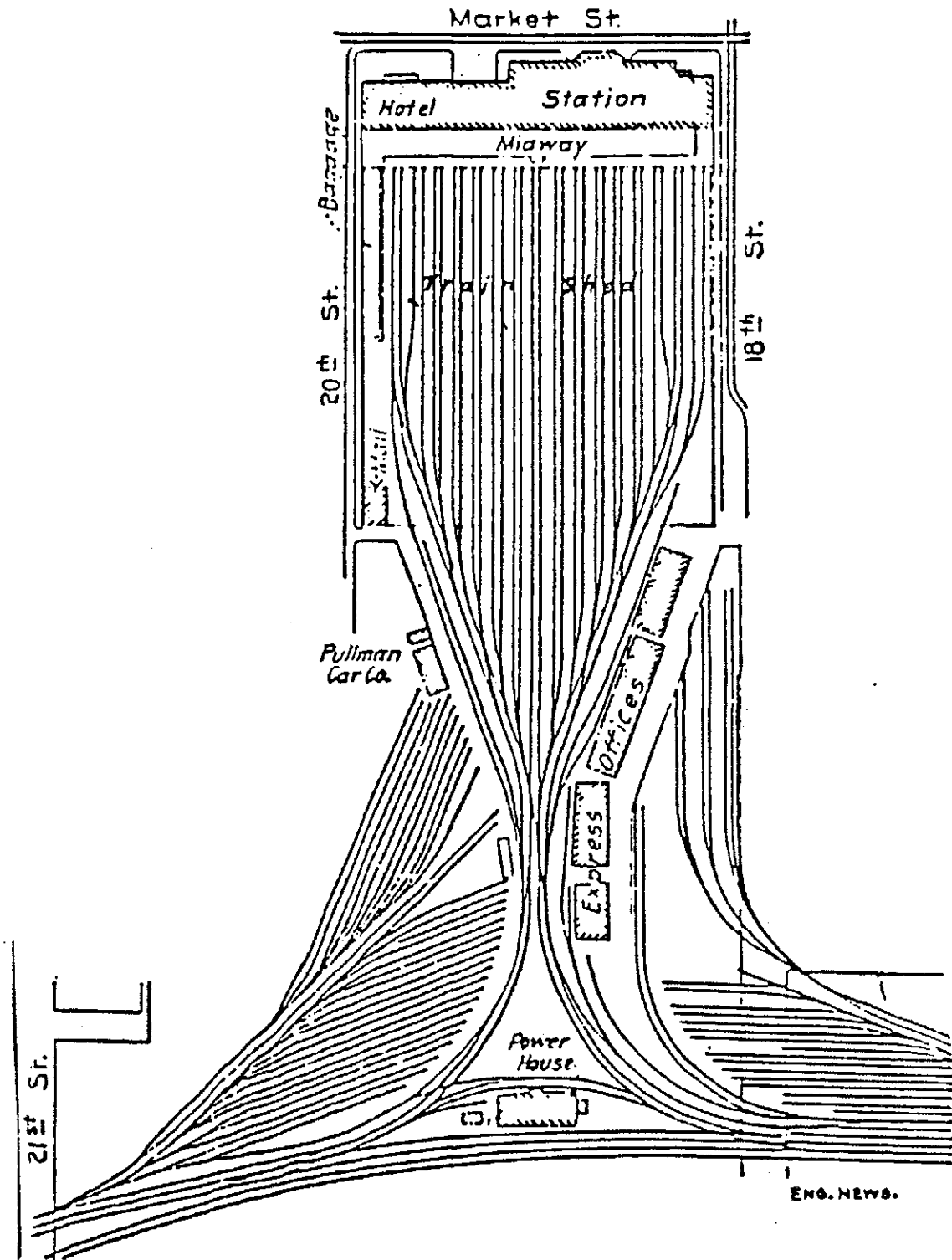
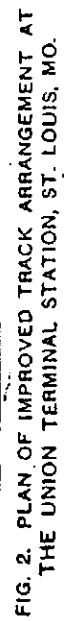


FIG. 1. ORIGINAL TRACK PLAN AT THE UNION TERMINAL STATION, ST. LOUIS, MO.



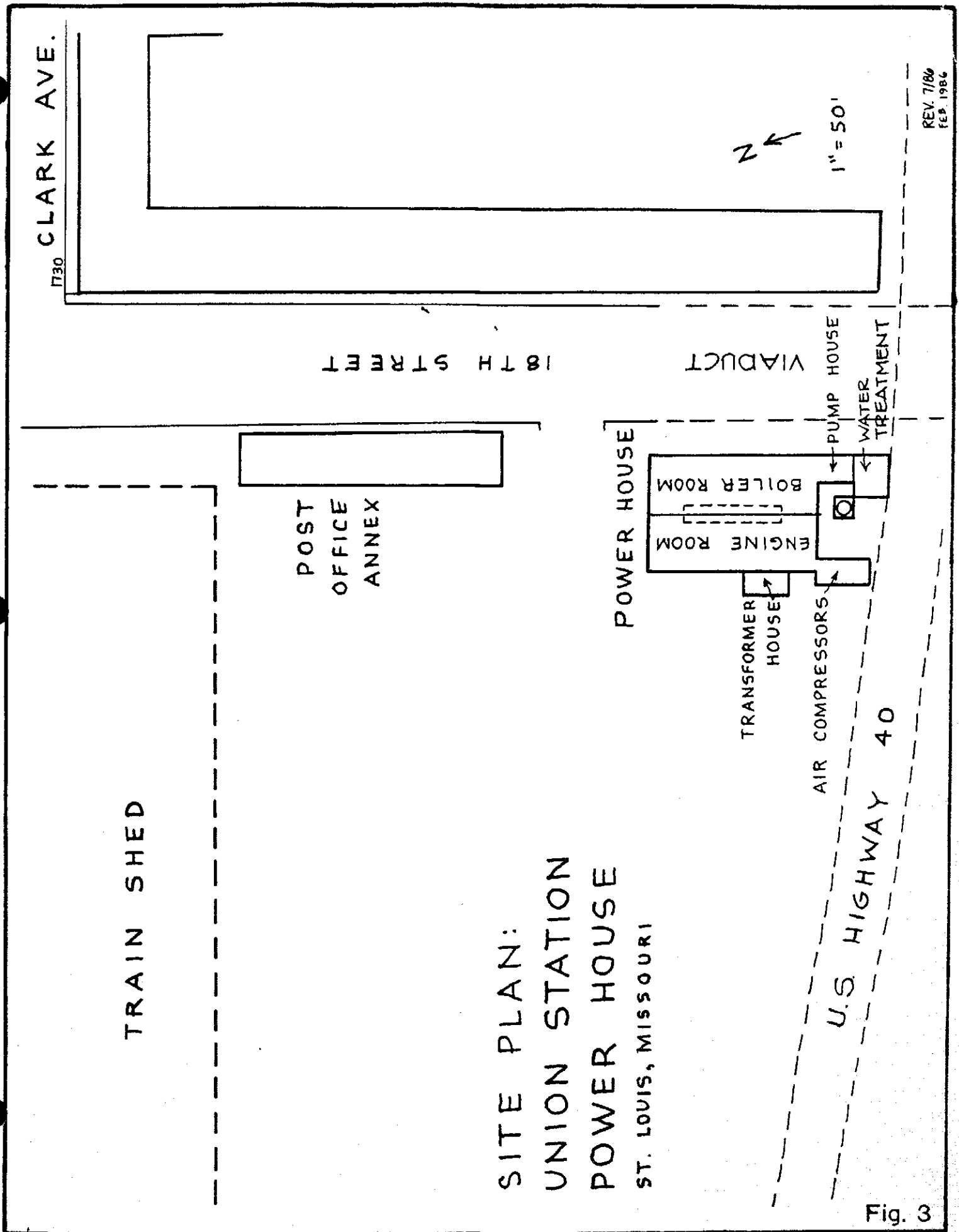


Fig. 3